Chirurgia Robotica: Quale Ruolonell'Urgenza

CARLO BERGAMINI, MD
AOU-CAREGGI
FIRENZE

L'urgenza chirurgica: sfide e bisogni

Requisiti dell'Emergenza

- Rapidità decisionale e operativa
- Sicurezza per il paziente critico
- Adattabilità a situazioni imprevedibili
- Disponibilità immediata delle risorse

Approcci Tradizionali

Gli interventi d'urgenza sono tradizionalmente dominati da tecniche chirurgiche open o laparoscopiche, consolidate e rapide da eseguire

Limiti Operativi

L'urgenza pone vincoli significativi:

- tempi ristretti per la preparazione
- disponibilità del personale specializzato
- necessità di formazione continua

Limiti e criticità nell'uso robotico in urgenza

Disponibilità Tecnologica

Accesso limitato al sistema robotico durante le ore notturne e nei weekend, quando molte emergenze si verificano. Non tutti i centri dispongono di robotica H24

Tempi Operatori Prolungati

Durata degli interventi più lunga rispetto a laparoscopia e chirurgia open, fattore critico in situazioni d'emergenza dove ogni minuto conta

Costi Economici Elevati

Investimento iniziale significativo per l'acquisto del robot, costi di manutenzione e materiali monouso che gravano sui budget ospedalieri

Formazione Specialistica

Necessità di training continuo e approfondito per chirurghi e team operatorio, con curve di apprendimento lunghe e impegnative

Selezione del Paziente

Solo pazienti emodinamicamente stabili sono candidati idonei: l'instabilità emodinamica rimane una controindicazione assoluta all'approccio robotico

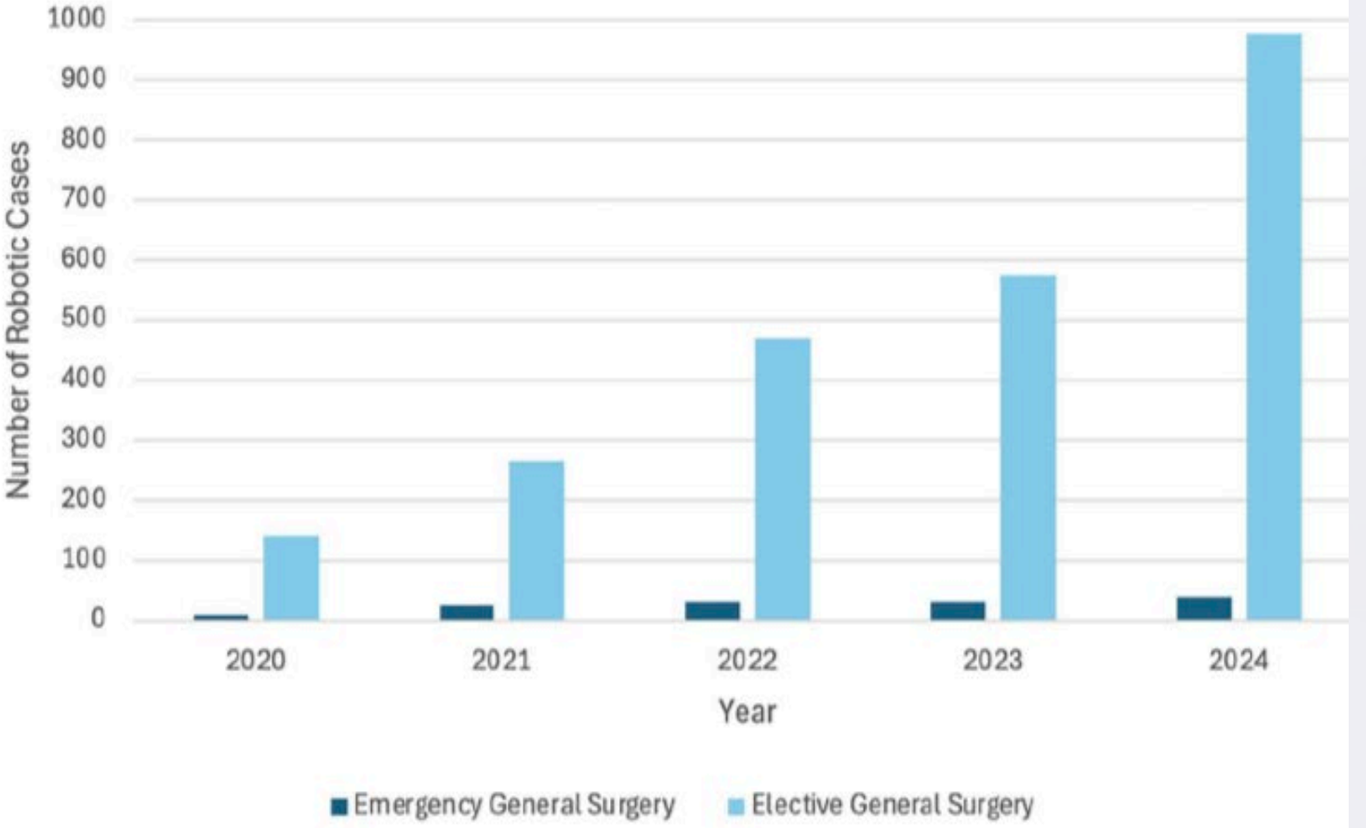
Robotic emergency general surgery, future or fallacy?: case-matched comparison of operative and clinical outcomes during the adoption phase in a tertiary centre

Kirsty Cole[1] · Azita Shahdoost-Rad[1] · Youssef Ibrahim[1] · Grace Chaplin[1] · Philip H. Pucher[1,2,3] on behalf of Portsmouth Robotic Research Group

1 Department of General Surgery, Portsmouth University Hospitals NHS Trust, Portsmouth, UK

2 Imperial College London, London, UK

Fig. 1 Temporal trend in robotic general surgery case volume from 2020 to 2024



SCIENTIFIC EVIDENCE

ANEDDOTICHE
< 2020

SYS REVTRIAL
(>2020)

1. WSES 2021
2. Arang 2023
3. Leanza 2025 (RA vs LA)
4. Poucher 2025

5.206.480 pazienti

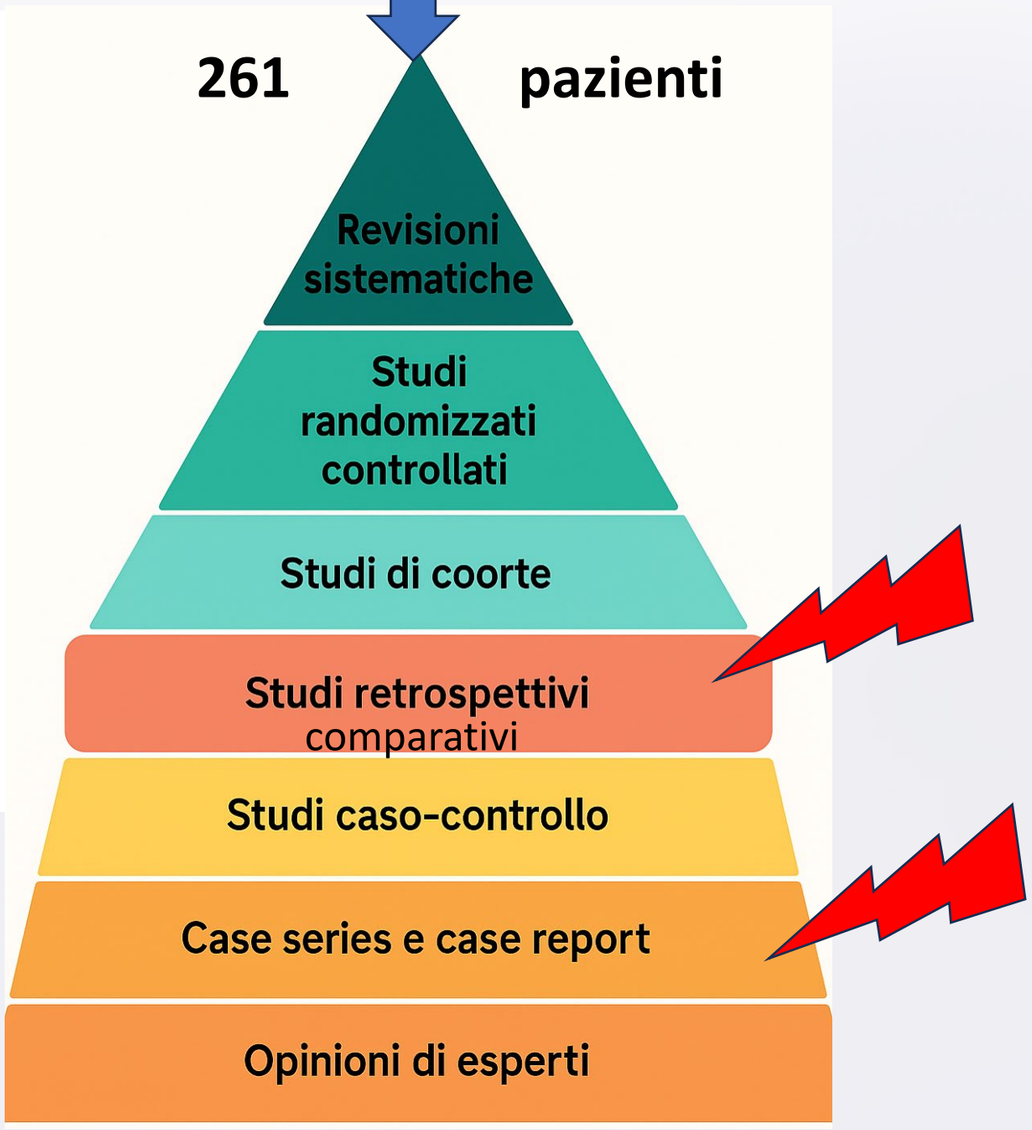
REVIEW Open Access

Robotic surgery in emergency setting: 2021 WSES position paper

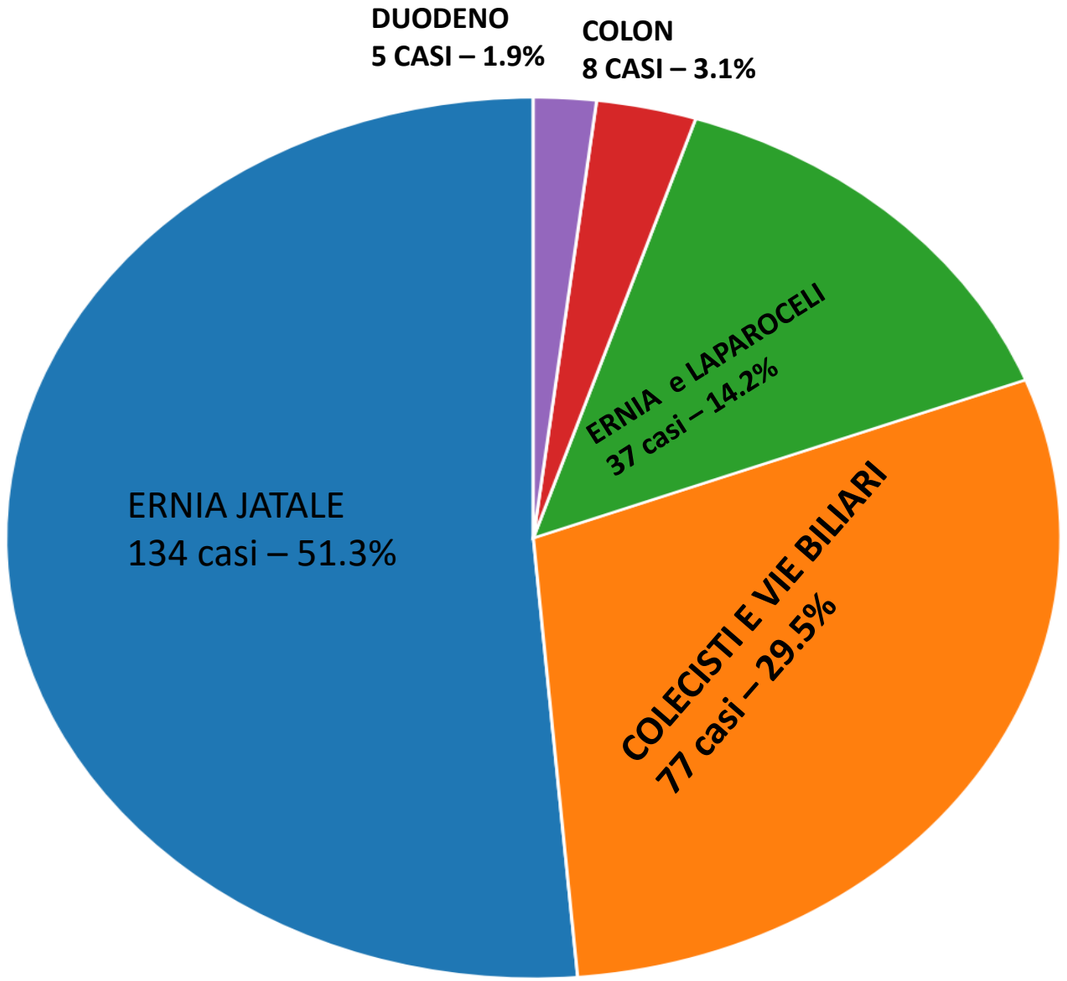
References	Study design	Nb. of patients	Time period	Pathology	Intervention	Robotic platform	Outcomes	Results
Comparative studies								
Hosein et al. [21]	Retrospective cohort study	131 robotic cases 719 open cases 1517 laparoscopic cases	January 2015–December 2017	Hiatal hernia	Hiatal hernia repair	Unknown	Perioperative outcomes	Trend towards better outcomes in minimally invasive surgery (laparoscopic and robotic) as compared to open approach
Kubat et al. [22]	Retrospective cohort study	76 robotic (elective) cases 74 robotic (urgent) cases	May 2001–August 2013	Acute cholecystitis, choledocholithiasis, severe chronic cholecystitis	Robotic single-site cholecystectomy	Intuitive Surgical da Vinci Si™	Perioperative outcomes and learning curve	Robotic single-site cholecystectomy is safe and can be applied to urgent and elective settings with acceptable perioperative outcomes. Learning curve of 50 cases
Robinson et al. [12]	Retrospective cohort study	4 robotic cases 0 laparoscopic cases	2015–2019	Perforated gastrojejunal ulcers following Roux-en-Y gastric bypass surgery	Repairs of perforated gastrojejunal ulcers	Intuitive Surgical da Vinci Si™/Xi™	Perioperative outcomes	Outcomes are non-inferior to laparoscopy with the use of the robot. In-room-to-surgery time is reduced in the robotic group. Costs are greater in the robotic group
Anderson et al. [9]	Retrospective cohort study on a prospective database	6 robotic cases 13 laparoscopic cases	February 2015–February 2017	Severe acute ulcerative colitis	Subtotal colectomy	Intuitive Surgical da Vinci Xi™	Feasibility and perioperative outcomes	Robotic subtotal colectomy has similar perioperative outcomes of laparoscopic subtotal colectomy
Case series and case reports								
Kudsi et al. [25]	Case series	34 robotic cases	February 2013–November 2019	Ventral hernia	Robotic ventral hernia repair	Intuitive Surgical da Vinci™	Perioperative outcomes and mid-term follow-up	Robotic ventral hernia repair is effective in the emergency setting
Ceccarelli et al. [21]	Case series	3 robotic cases	December 2009–December 2019	Giant hiatal hernia	Hernia repair ± fundoplication	Intuitive Surgical da Vinci Xi™	Perioperative outcomes	Uneventful postoperative course in
Milone et al. [23]	Case series	3 robotic cases	2019	Moderate acute calculous cholecystitis	Robotic cholecystectomy	Intuitive Surgical da Vinci Si™	Perioperative outcomes	Uneventful postoperative course
Sudan et al. [24]	Case report	Robotic cases	2001	Complications of biliopancreatic diversion with duodenal switch	Robotic stricturoplasty Robotic suture of duodenal stump	Intuitive Surgical da Vinci Si™	Perioperative outcomes	Uneventful postoperative course
Felli et al. [10]	Case report	1 robotic case	2014	Hemorrhagic right colon cancer	Robotic right colectomy with double-barreled ileocolostomy	Intuitive Surgical da Vinci Si™	Perioperative outcomes	Uneventful postoperative course. At 5 months of follow-up, no recurrence was noted
Pedraza et al. [19]	Case report	1 robotic case	2001	Iatrogenic colonoscopy perforation	Robotic colorrhaphy	Intuitive Surgical da Vinci Si™	Perioperative outcomes	Uneventful postoperative course

10 STUDI

261 pazienti



Distribuzione degli interventi (totale = 261



REVIEW Open Access

Robotic surgery in emergency setting: 2021 WSES position paper

PS-1. Robotic surgery in emergency settings is highly dependent on the surgeon's experience and should only be performed in an appropriately equipped operating

Level of evidence: case reports and case series → expert opinion
Strength of consensus (based on the survey evaluation): 100%

PS-2. Robotic surgery in emergency settings may be considered in highly selected clinically stable patients only.

Level of evidence: case reports and case series → expert opinion
Strength of consensus: 94.6%

PS-3. Robotic surgery may be considered in challenging situations, which are foreseen as a reason for conversion to open surgery if operating in laparoscopy.

Level of evidence: case reports and case series → expert opinion.
Strength of consensus: 83.8% (based on the survey evaluation)

PS-5. The increased costs need to be justifed in the context of an efficient implementation of robotic surgery. Currently, the availability and accessibility of the robotic platforms for emergencycare surgical units are very limited.

Sultan Qaboos University Med J, November 2023, Vol. 23, Iss. 4, pp. 440–446, Epub. 30 Nov 23
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https://doi.org/10.18295/squmj.7.2023.043
REVIEW

Robotic Appendicectomy
A review of feasibility

2023

Hossein Arang[1] and *Michael El Boghdady[2,3]

Author and year of publication	Journal	Type of study	Objective	Patients (n)	Indications	Robotic system	Findings/outcomes	MERSQI scores* (Quality)
Akl *et al.*[17] (2008)	The International Journal of Medical Robotics and Computer Assisted Surgery	Cohort study	To assess the feasibility, safety and pathological findings of incidental RA in patients undergoing robotic gynaecological surgeries.	Altogether Elective RA 107 patients.	Chronic pelvic pain and gynaecological malignancies.	Da Vinci robotic system	Incidental RA was performed safely and effectively in conjunction with other robotic gynaecological procedures with no perioperative complications related to appendicectomy.	13 (high)
Yi *et al.*[18] (2016)	Surgical Endoscopy	Case report	To develop and validate one low-cost and easy-use minimally invasive surgical robot system "Micro Hand S" that surgeons can use to resolve the complicated surgeries challenge.	Altogether, 10 patients (Emergency RA = 3)	Acute appendicitis	Micro Hand S robotic surgery	No intraoperative complications or technical problems were encountered with the use of the domestic produced "Micro Hand S" All patients recovered and were discharged from hospital without complications.	8 (low)
Yi *et al.*[19] (2017)	Surgical Endoscopy	Case series	To assess the safety and feasibility of the Chinese minimally invasive surgical robot system "Micro Hand S" in its first clinical use	Altogether, three patients (Emergency RA = 2)	Acute appendicitis	Micro Hand S robotic surgery	The robot system "Micro Hand S" was safe and effective with no intraoperative complications or technical problems being encountered with its use. At three-month follow up, patients had no adverse reactions.	8 (low)
Bütter *et al.*[20] (2017)	Journal of Robotic Surgery	Cohort study	To present the results of the first paediatric robotic surgery program in Canada.	Altogether, 41 children Interval RA = 1	Interval appendicectomy.	Da Vinci robotic system	All robotic procedures were completed without conversion, with no technical failures due to the robotic system.	13 (high)
Orcutt *et al.*[21] (2017)	International journal of surgery case reports	Case series	To present cases with appendiceal mucoceles that were successfully treated with minimally invasive approaches.	Altogether, two patients Elective RA = 1	Mucocele of appendix	Unclear	The robotic approach allowed meticulous dissection and intact removal of appendiceal mucocele with no intra- or post-operative complications.	6.5 (low)
Hüttenbrink *et al.*[22] (2018)	Langenbeck's Archives of Surgery	Cohort study	To investigate the safety and patients benefit of incidental appendicectomy during RALRP.	Altogether, 53 patients Elective RA = 53 Histopathology: inconspicuous = 33, post inflammatory changes = 11,chronic appendicitis = 4, appendicitis = 3 and neoplasia = 2	RALRP with incidental appendicectomy	Da Vinci robotic system	Incidental appendicectomy during RALRP is a feasible and safe procedure and could be considered for patients scheduled for robot-assisted prostate surgery.	13.5 (high)
Yao *et al.*[23] (2020)	International Journal of Surgery	Cohort study	To evaluate the feasibility and safety of the Micro Hand S surgical robot in general surgery.	Altogether, 81 patients (Emergency RA = 3)	Acute appendicitis	Micro Hand S robotic surgery	RA was successfully performed in all three patients.The operative time (min) 130.0,blood loss (ml) 40.0 and hospital stay (day) 6.3	
Kelkar *et al.*[24] (2020)	Surgical Endoscopy	Cohort study	To provide an initial safety analysis of the first 30 surgical procedures performed using the Versius Surgical System.	Altogether, 30 patients (Emergency RA = 4)	Acute appendicitis	Versius Surgical System	RA was successfully performed in all four patients.The operation time ranged between 80-135 minutes and estimated intraoperative blood loss was negligible.	
Quilici *et al.*[25] (2021)	Surgical Endoscopy	Cohort study	To define the value, cost and fiscal impact of robotic-assisted procedures in abdominal surgery and provide clinical guidance for its routine use.	Altogether, 34,984 patients (few unspecified number RA)	Abdominal surgery including AA	Da Vinci surgical system	RA were performed at a higher cost vs laparoscopic appendicectomy, with an average total cost per case $13,210 vs $7,709. Robotic technology for gastrointestinal procedures is significantly more expensive than other surgical techniques.	

STUDIO REG. IN PROSPERO

9 STUDI, 20 ANNI > 35000 PZ,
SOLO 12 URGENZA

- Conversione: minimo o nullo
- Perdita ematica trascurabile (<5 mL)
- Durata media della degenza ospedaliera 5,2 giorni
- COSTI 13.210 *Vs* 7.709 per la LA

FATTIBILE

TROPPO COSTOSO E LUNGHI TEMPI

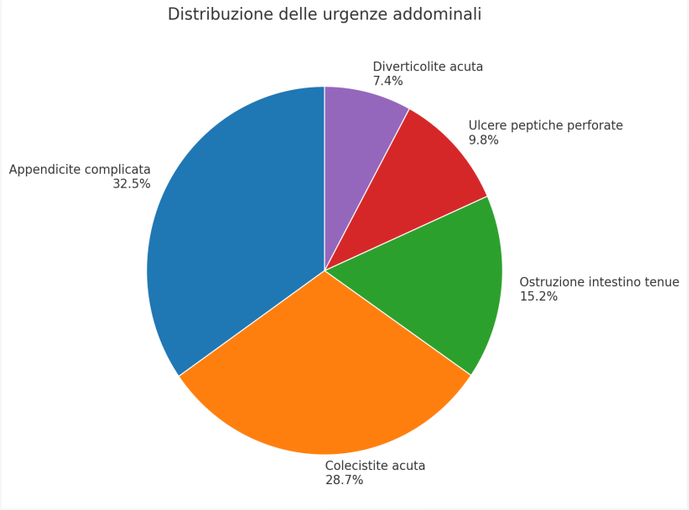
REVIEW

Robotic-assisted surgery for acute abdominal emergencies: a systematic review of 1142 cases

Danilo Coco[1] · Silvana Leanza[1]

VS 2310 pazienti LA E OA

Characteristic	Value	Notes
Total studies included	27	studi > 10 pazienti
Total procedures analyzed	1,142	
Geographic distribution		
- North America	52% (14 studies)	Predominantly US-based centers
- Europe	33% (9 studies)	Mainly Italy, France, Germany
- Asia	15% (4 studies)	Primarily South Korea, Japan
Study design		
- Retrospective	70% (19 studies)	
- Prospective	30% (8 studies)	Includes 2 randomized controlled trials
Mean patient age (years)	48.5 ± 14.2	Range: 18–82
Sex distribution	54% male, 46% female	
BMI (kg/m^2)	28.3 ± 5.1	Obese subgroup: 32% (BMI ≥ 30)
ASA classification		
- ASA I–II	68%	
- ASA III–IV	32%	



Outcome metric	Robotic (n = 1,142)	Laparoscopic (n = 2,310*)	p-value	Clinical implication
Mean operative time (min)	152 ± 39	126 ± 34	0.003	21% longer with robotics
Estimated blood loss (mL)	85 ± 28	120 ± 45	0.03	29% reduction with robotics
Overall conversion rate	9.10%	12.70%	0.04	28% relative risk reduction
Obese patient conversions	11.30%	18.60%	0.04	Greater benefit in BMI ≥ 30
Major complications	13.20%	14.70%	0.21	Non-inferior safety
Hospital stay (days)	4.1 ± 2.3	4.4 ± 2.6	0.15	Comparable recovery

Procedure	Cases (n)	Operative time (min)	Conversion rate (%)	Key complications (%)	Notable findings
Complicated appendicitis	371	128 ± 32	6.5	Intra-abdominal abscess (3.2%)	Lower conversion vs. laparoscopic (9.8%)
Acute cholecystitis	328	142 ± 28	8.1	Bile duct injury (0.6%), bile spillage (12.3%)	Superior safety in Tokyo II/III cases
Small bowel obstruction	174	156 ± 41	11.4	Enterotomy (4.6%)	Reduced iatrogenic injury risk
Perforated peptic ulcer	112	98 ± 23	4.2	Leak rate (2.7%)	High primary repair success (92.8%)
Acute diverticulitis	85	184 ± 37	7.0	Anastomotic leak (3.5%)	Comparable to open outcomes

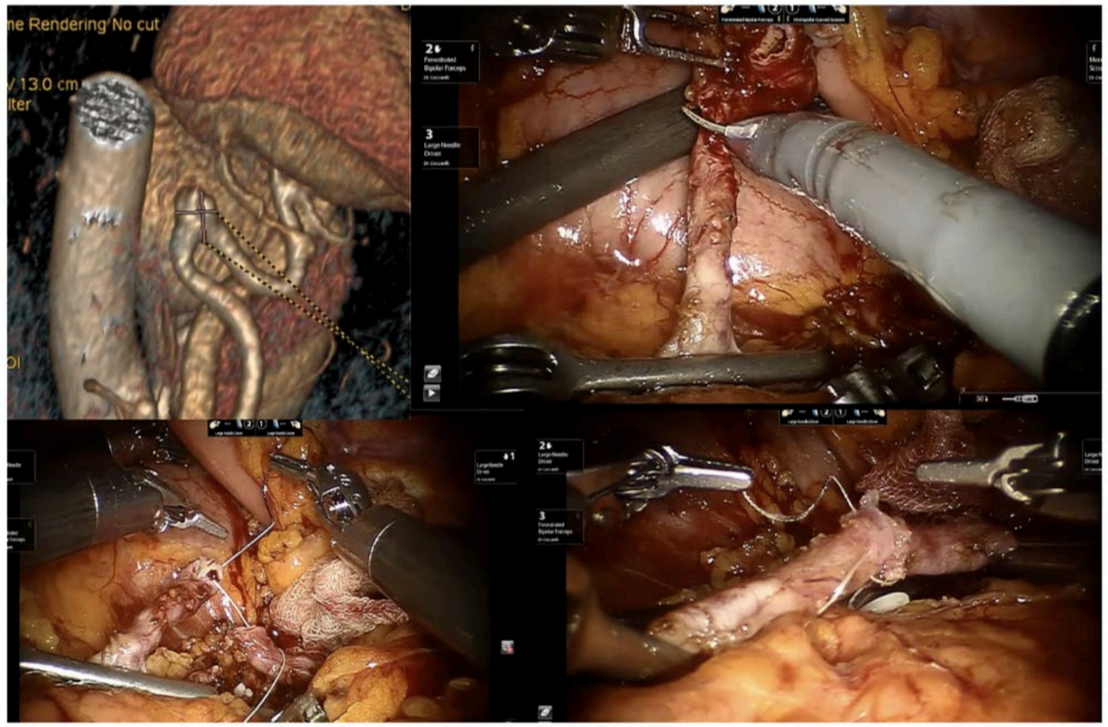
Factor	Odds ratio (95% CI)	p-value	Adjusted analysis
Matted adhesions (SBO)	3.2 (1.8–5.7)	< 0.001	Strongest predictor
Tokyo III cholecystitis	2.1 (1.2–3.8)	0.01	twofold increased risk
Hinchey II diverticulitis	1.9 (1.1–3.3)	0.03	
BMI ≥ 35	1.7 (1.2–2.5)	0.04	Persistent after adjustment
Prior abdominal surgery	1.5 (1.1–2.1)	0.02	

Parameter	Robotic	Laparoscopic	Difference
Mean direct costs (USD)	$14,520 ± $2,810	$9,850 ± $1,970	47%
Disposable equipment	$2,150/procedure	$480/procedure	348%
OR setup time (min)	38 ± 12	22 ± 8	73%
Readmission rate	5.20%	6.80%	− 23%
Reoperation rate	2.10%	3.40%	− 38%

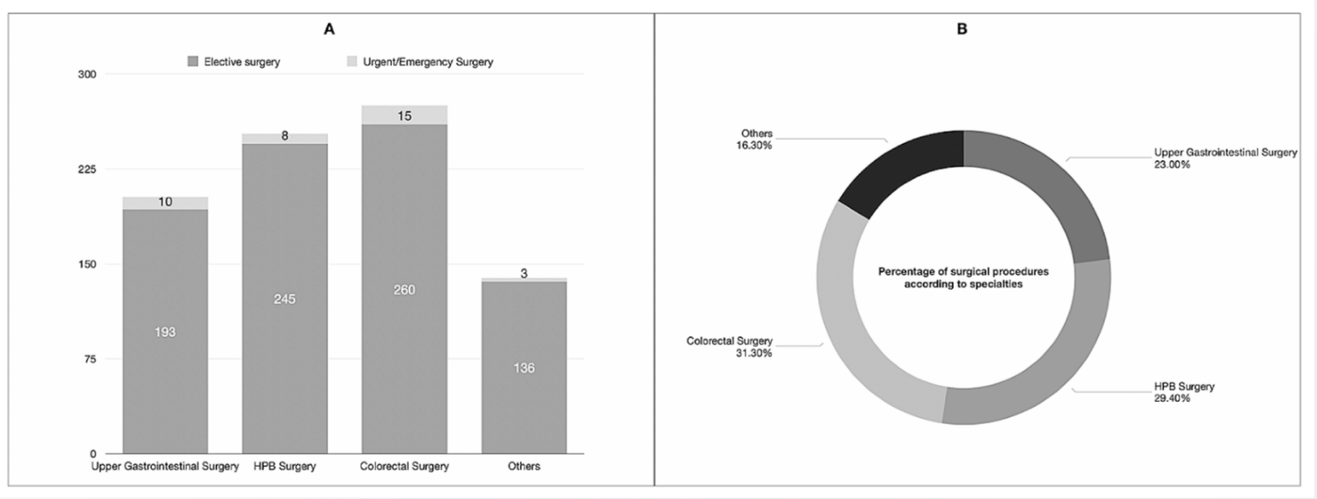
RESEARCH Open Access

Emergency robotic surgery: the experience of a single center and review of the literature

Graziano Ceccarelli[1], Fausto Catena[2], Pasquale Avella[3,4*], Brian WCA Tian[5], Fabio Rondelli[1], Germano Guerra[4], Michele De Rosa[1] and Aldo Rocca[3,4]



36 U / 834 E = 4.3%



REVIEW DI 50 LAVORI!!!!

- Xi® >> Si®
- Colecistectomia robotica single-site
- Sindrome di Mirizzi
- Erni addominali
  < conversione
  > ambulatoriali

REVIEW

Current evidence and reported experiences for robot-assisted emergency general surgery: systematic review

2025

Youssef Ibrahim[1] · Mahin Azim Rahman[1] · Oliver Pickering[1] · Kirsty Cole[1,2] · Philip H. Pucher[1,2,3]

20 studi 5.206.480 pazienti

Study	Data source	Procedure	Pathology	n	Robot System	NOS
Latif, 2024, UK	Single centre 2022–23	Rob chole	Biliary	23	Da Vinci X	6
Shapera, 2024, USA	Single centre 2021–22	Rob chole	Biliary	26 (AH) vs 20 (RH)	Da Vinci Xi	7
Shen, 2024, USA	Single centre 2021–22	Rob vs Lap chole	Biliary	89 vs 361	Da Vinci Xi	8
Klein, 2024, USA	Single centre 2021–24	Rob vs Lap chole	Biliary	130 vs 130	Da Vinci	8
Greenberg, 2024, USA	Multi-centre database 2020–22	Rob vs Lap chole	Biliary	3151 vs 26,786	Not specified	9
Kudsi, 2020, USA	Single centre 2013–19	Rob ventral hernia repair	Ventral/ incisional hernia	34	Da Vinci	7
Iaquinandi, 2024, Switzerland	Single centre 2020–24	Rob hiatus hernia repair	Hiatal hernia	17	Da Vinci Xi	6
Bou-Ayash, 2021, USA	Single centre 2020	Rob IHR	Inguinal hernia	19	Da Vinci	7
Testa, 2023, Switzerland	Single centre 2018–23	Rob vs open IHR	Inguinal hernia	15 vs 19	Not specified	8
Maertens, 2022, UK	Single centre 2020–21	Rob colectomy	Mixed colon pathology	10	Da Vinci X	7
Anderson, 2019, USA	Single centre 2015–17	Rob vs lap colectomy	Ulcerative colitis	6 vs 13	Da Vinci Xi	6
Arnott, 2022, USA	NSQIP database 2012–19	Rob vs lap colectomy	Diverticulitis	297 vs 6,583	Da Vinci	7
Charland, 2024, USA	NIS database 2008–20	Rob vs lap, multiple acute procedures	Multiple	65,853 vs 3,974,702	Not specified	9
Sanderfer, 2024, USA	NSQIP database 2022–23	Non-elective vs elective rob procedures	Multiple	133 (non-elective) vs 67 (elective)	Not specified	8
Grimsley, 2023, USA	Florida Agency for Healthcare Administration database 2018–20	Rob vs lap, multiple acute procedures	Multiple	3,751 vs 56,982	Not specified	9
Lunardi, 2024, USA	Premier Healthcare	Rob vs lap/open, multi-	Multiple	1,067,263	Not specified	9

- **Conversione**. Colecistectomia: 1,7% vs 3,0% per robotica vs laparoscopica, p<0,001; Colectomia: 11,2% vs 25,5%, p<0,001.

- **I tempi operatori**: costantemente più lunghi per gli approcci robotici rispetto alle tecniche laparoscopiche (es. Colecistectomia robotica 176 min vs Laparoscopica 109 min, p<0,001).

- **Esiti Clinici:**
  - **Durata della degenza (LOS):** Generalmente comparabile. Tre studi LOS statisticamente significativa più breve con la chirurgia robotica per colectomie, riparazioni di ulcere peptiche perforate e adesiolisi.
  - **Tassi di Ri-ammissione:** Non sono state riscontrate differenze
  - **Tassi di Complicanze**: Arnott et al. e Grimsley et al. hanno riportato tassi significativamente inferiori nel gruppo robotico. Grimsley et al. hanno anche riscontrato ricoveri in terapia intensiva significativamente più elevati nel gruppo laparoscopico

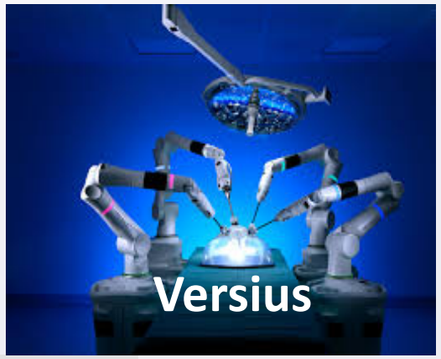
- **Costi:** tutti gli studi confermano costi più elevati nei robotici

REVIEW

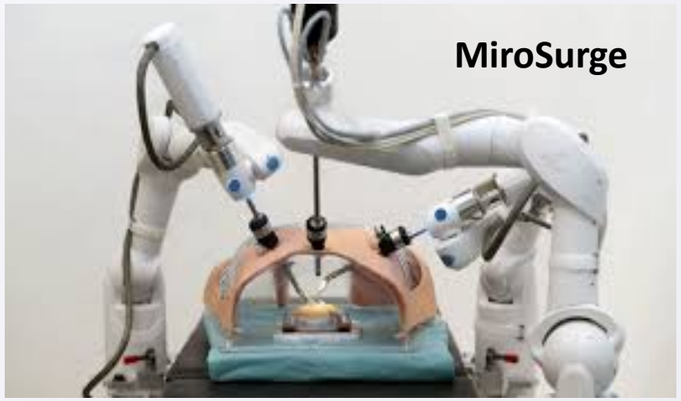
Current evidence and reported experiences for robot-assisted emergency general surgery: systematic review

2025

Youssef Ibrahim[1] · Mahin Azim Rahman[1] · Oliver Pickering[1] · Kirsty Cole[1,2] · Philip H. Pucher[1,2,3]



SISTEMI ROBOTICI



50 CENTRI INTERNAZIONALI

DATI MALATTIA

- **Colecistiti**
- **Diverticoliti**
- **Ernia**
- **Altre**

1 ANNO F.UP

DATI OPERATIVI

- **Dati demografici**
- **N° interventi**
- **Esperienza**
- **Modello e procedura**
- **Tempo Operatori**
- **Complicanze e conversioni**

Milone *et al.*
World Journal of Emergency Surgery (2024) 19:20
https://doi.org/10.1186/s13017-024-00542-x

World Journal of Emergency Surgery

STUDY PROTOCOL Open Access

The role of RObotic surgery in EMergency setting (ROEM): protocol for a multicentre, observational, prospective international study on the use of robotic platform in emergency surgery

Marco Milone[1], Pietro Anoldo[1*], Nicola de'Angelis[2], Federico Coccolini[3], Jim Khan[4], Yoram Kluger[5], Massimo Sartelli[6], Luca Ansaloni[7], Luca Morelli[3], Nicola Zanini[8], Carlo Vallicelli[8], Gabriele Vigutto[8], Ernest E. Moore[9], Walter Biffl[10], Fausto Catena[8] and ROEM Collaborative Group

ESITI POST-OPERATORII

- **Canalizzazione**
- **Mobiizzazione**
- **Degenza**
- **Clavien-Dindo**
- **Mortalità**
- **Riammissine**
- **COSTI**

SELEZIONE DEI PAZIENTI E DELLE PATOLOGIE IN CUI E' INDICATO L'APPROCCIO ROBOTICO

INFORMATIVA PER ALLOCAZIONE DI RISORSE E FORMAZIONE

conclusioni

Minerva Surg. 2025 Apr;80(2):193-194. doi: 10.23736/S2724-5691.25.10716-8.
Epub 2025 Feb 26.

Emergency robotic surgery: the beginning of new era in emergency setting

Alessio Giordano [1], Carlo Bergamini [1], Jacopo Martellucci [1], Maximilian Scheiterle [1], Annamaria Di Bella [1], Alessandro Bruscino [1], Paolo Prosperi [1]

Robotica vs Laparoscopia in emergenza: numeri chiave

Tasso di Conversione

Robotica: 1.7% vs Laparoscopia: 3.0%

Nella colecistectomia d'urgenza, l'approccio robotico dimostra una maggiore capacità di completare l'intervento senza ricorrere alla laparotomia

Complicanze

Tassi simili tra le tecniche

Sicurezza paragonabile con vantaggi tecnici evidenti: migliore visualizzazione, precisione nei movimenti e minor trauma tissutale

Degenza

Riduzione del 40%

Nella maggior parte delle casistiche esaminate vi è una riduzione della degenza rispetto alle procedure eseguite in laparoscopia fino al 40%

Durata Intervento e costi

152 minuti (±38 min – **Costi** 220%)

Tempo operatorio medio leggermente superiore alla laparoscopia, ma compensato da minori complicanze intraoperatorie

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Colecistectomia

Colectomia

Riparazioni Erniarie

conclusioni

Tempi e costi: le sfide da superare

L'equilibrio tra innovazione tecnologica e sostenibilità operativa rappresenta la sfida principale per l'implementazione della robotica in emergenza

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Strategie di implementazione e formazione

Training Specifico

- Programmi di formazione dedicati all'emergenza
- Simulatori avanzati per scenari urgenti
- Certificazioni specialistiche
- Valutazione continua delle competenze

Integrazione Clinica

- Protocolli per percorsi urgenti selezionati
- Criteri di inclusione/esclusione chiari
- Disponibilità robot H24 progressiva
- Team dedicati all'emergenza robotica

Innovazione Tecnologica

- Telechirurgia per supporto remoto
- Telementoring in tempo reale
- Condivisione di best practices
- Reti collaborative tra centri

conclusioni

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Raccomandazioni per l'adozione del robot in emergenza

1 Selezione accurata del paziente

Stabilità emodinamica come criterio fondamentale. Valutazione pre-operatoria rapida ma completa. Score di rischio specifici per l'emergenza robotica

2 Investimento in infrastrutture

Disponibilità robot H24, sale operatorie dedicate, personale formato e sempre disponibile. Budget adeguati per manutenzione e aggiornamenti tecnologici

3 Formazione continua

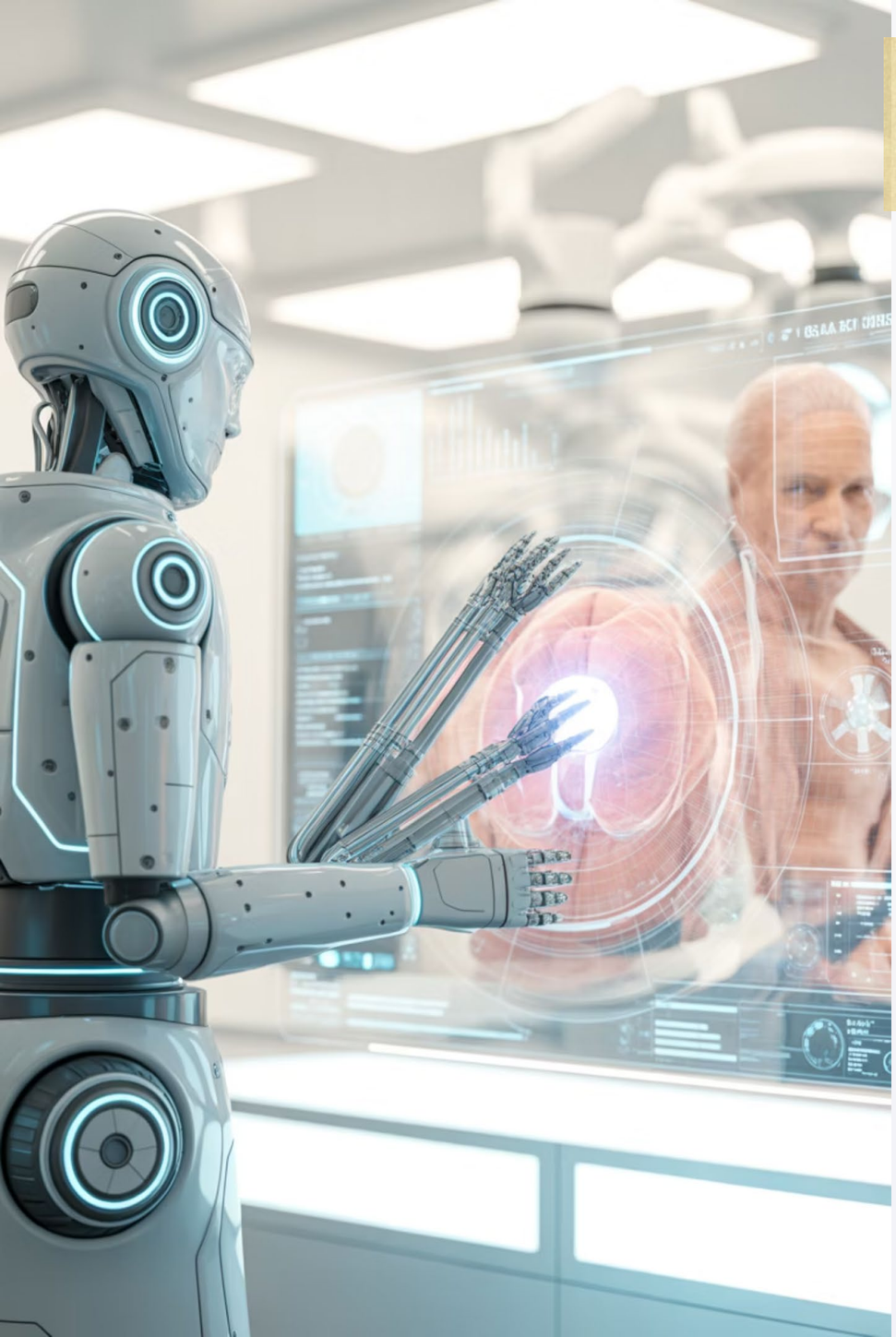
Programmi di training strutturati, simulazioni regolari, certificazioni periodiche. Aggiornamento costante sulle nuove tecnologie e tecniche

4 Collaborazione tra centri

Reti di centri ad alto volume per condivisione di protocolli, esperienze e best practices. Telemedicina per supporto remoto nelle emergenze complesse

5 Monitoraggio e ricerca

Raccolta sistematica dei dati, audit regolari, studi prospettici multicentrici. Valutazione continua degli outcome e costo-efficacia



conclusioni

› Minerva Surg. 2025 Apr;80(2):193-194. doi: 10.23736/S2724-5691.25.10716-8. Epub 2025 Feb 26.

Emergency robotic surgery: the beginning of new era in emergency setting

Alessio Giordano [1], Carlo Bergamini [1], Jacopo Martellucci [1], Maximilian Scheiterle [1], Annamaria Di Bella [1], Alessandro Bruscino [1], Paolo Prosperi [1]

Visione futuristica della chirurgia robotica

L'integrazione di intelligenza artificiale, realtà aumentata e feedback aptico trasformerà radicalmente la chirurgia d'urgenza nei prossimi anni

Uomo e macchina: alleati nell'urgenza chirurgica

La vera rivoluzione non sta nella sostituzione del chirurgo, ma nell'amplificazione delle sue capacità attraverso la tecnologia robotica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d'Urgenza e del Trauma

Grazie